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A study of knowledge management used for managing quality systems in selected manufacturing organizations in Coles and Effingham Counties

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A Study of Knowledge Management Used for Managing Quality Systems

in Selected Manufacturing Organizations in Coles and Effingham Counties
(TITLE)

BY

Merlin Haryati

THESIS

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Abstract

The globalization and information revolutions increase the complexity and competition resulting in a business environment that is no longer stable and static. Executives of all organizations face the challenge of adopting new management practices to keep their organizations vibrant in a rapidly changing technological business world. Knowledge management is one of the emerging fields that promise workplace improvements by putting the tacit knowledge of the company into use.

The emergence of knowledge management in the year 2000 caused organizations to realize that their intellectual assets are central to their survival. Managing and harvesting these assets is the focus of knowledge management. Quality management focuses on continuous improvement and it depends on the intellectual capital of organizations. Knowledge assets of organizations are stored in their knowledge repository. Thus, it can be said that the quality of the knowledge repository depends on the investment the organization makes in human resources.

This study explores the link between knowledge management and quality systems management to determine the application of knowledge management used for managing quality systems in selected organizations at Coles and Effingham counties in central Illinois.

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Table of Contents

Table of Contents, Cont'd

List of Tables

Table **Page**

List of Figures

Figure **Page**

Running head: STUDY OF KNOWLEDGE MANAGEMENT USED FOR MANAGING QUALITY SYSTEMS

A Study of Knowledge Management Used for Managing Quality Systems in Selected Manufacturing Organizations in Coles and Effingham Counties

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Chapter 1

Introduction

The environment in which business is conducted has shifted over several decades. Today's business environment is full of challenges due to two major trends that took place during the 20th century: globalization and the information revolution; particularly growth of communication technology (e.g., Internet), triggering e-business. These trends increase the complexity and competition resulting in an environment that is no longer stable and static. The advance in information technology creates an enormous amount of information. Organizations not only deal with the question of how much information is needed (volume) but also of how this information moves through the organization and on how the organization uses that information to its benefit. Consequently executives of an organization face the challenge of adopting new management practices to keep the organization vibrant in a rapidly changing technological business world.

New management techniques for improvement are being adopted by companies that want to remain relevant and competitive in a rapidly changing technological business world. Knowledge management is one of the emerging fields that promise workplace improvements by putting the tacit knowledge of the company into use. Tacit and explicit knowledge are two important resources of knowledge available to an organization. Explicit knowledge exists in an organization in the form of manuals, presentations, procedures, books, policies, and other formats, which are in the public or private domain. Tacit knowledge, on the other hand, is very personal and it exists within individuals. Converting tacit knowledge into explicit knowledge is a key to success for any organization. Knowledge management (KM) has been gaining interest in today's

business and academic community. KM is the process of managing organizational knowledge and transforming it into business value. KM actively leverages the know-how, experience, and judgment that reside within organizations and outside organizations that aim at improving organizations' problem solving skills, promoting dynamic learning, assisting in strategic planning and decision making.

Knowledge management needs a systematic method of managing corporate memory because without a collective long-term memory for the organization, there is no foundation for organization learning to occur. Organizations must develop a method for transferring the individual knowledge into long- term organization knowledge so that this knowledge can be easily accessed by new generations.

In the 1980s quality management (QM) became a popular management tool. Since then quality has been an important aspect of organizations to ensure the value of products and/or services to customers. In the business world of today, every organization implements and uses quality principles and tools in its operations. Quality has become a daily activity. It is important that most organizations have their own quality department with quality engineers. Quality redefines how manager of organizations deal with workers, customers, and suppliers. It focuses on eliminating the cause of problems, waste and rework. Today's quality management has grown beyond the responsibility of the quality department. Quality is now recognized as everyone's job. Thus every employee is responsible for quality.

Quality began with an emphasis on collecting data on processes, analysis using statistical process control, identifying relationships in the data, and focusing on process

capability. Quality methods and tools provide the means to continuously improve processes and optimize performance of organizations.

In this study, the relationship between two management approaches (KM and QM) will be discussed, including their similarities and differences. The study will focus on knowledge creating companies, knowledge management principles and techniques, quality system principles and methods. Initially, the study will point out the similarities and differences among them. A survey research including interviews and questionnaires will be used to determine the extent to which KM is used in managing quality systems, and used in the organizations to stimulate the processes of implementing KM for quality systems in selected manufacturing organizations. This will be followed by the findings and conclusions of the study.

Statement of Problem

The emergence of knowledge management since 2000 has caused organizations to realize that their intellectual assets are central to their survival. Managing these assets is the focus of knowledge management. It is very difficult, however, to determine which knowledge must be kept and which one must not. This problem opens a very different possibility arising for quality systems management. Can quality tools and measures be used to determine the quality of the knowledge? Can quality professionals help to determine the quality of information and knowledge? What important influences does quality management (QM) have on knowledge management (KM)?

Quality depends on the intellectual capital of organizations, which is the organization's knowledge network focusing on continuous improvement. More specifically, employees of organizations are required to do more knowledge work, where

responsibilities increase. Wilson et al. (1999) stated that statistics indicate that by the year 2000 knowledge workers will constitute up to 30% of the U.S. work force and that number is expected to increase. An organization's knowledge is stored in the knowledge repository. Thus it can be said that the quality of the knowledge repository depends on the investment in the organization's human resources.

The end result of KM and QM is to convert organization assets into actual value. The difference is in the way the assets are managed. Quality, however, has well-established metric measurements. Under quality management every process is measured. Knowledge on the other hand is intangible in nature and therefore it is hard to measure. Organization might as well manage knowledge without actually measuring it.

Even though both management systems are important to the organization, few studies have explored the link between those two systems. Therefore, this study intends to find the link between both management systems as well as to find the opportunities of KM applications on quality systems management.

Statement of Purpose

The purpose of this study is to determine the application of knowledge management techniques used for managing quality systems in selected manufacturing organizations. The outcome of the study will be used to establish a framework for examining the relationship that exists between knowledge management principles and techniques and the implementation and management of quality systems in selected manufacturing organizations. The intent is to identify the effective way of using knowledge management to effectively manage quality systems.

Research Questions

1. To what extent are knowledge management (KM) and quality management (QM) techniques used in selected manufacturing organizations in central Illinois?
2. To what extent is knowledge shared and used to improve processes at local sites as well as other sites of organizations?
3. Does knowledge management support quality management in creating a competitive advantage for organizations?
4. Can quality teams re-use available knowledge to achieve commitment to change in responding to rapid change in business environments?

Assumptions

It is assumed that all respondents will participate truthfully in this research as well as answer questions honestly. It is also assumed that respondents will understand the meaning of knowledge management, quality management and have experience in managing quality.

Delimitations

This study focuses on knowledge management techniques used for managing quality systems in small to medium size manufacturing organizations in Coles and Effingham counties, Illinois. Knowledge Management is a more holistic approach to managing knowledge of the organization, the scope of this study, however, is limited to quality system departments in the organizations in central Illinois.

Limitations

Knowledge resides within individuals, thus communication management is essential in creating and managing knowledge. The concept of quality must be

communicated in every function of an organization with the objective of creating awareness of its importance. One of the major approaches in quality systems is process improvement, which requires extensive communication and collaboration from various elements in organizations. Organizations have to have adequate communication channels in order to effectively manage quality.

Organization culture plays a vital role in effective knowledge management and quality management. The culture should create an open environment in which care, respect, trust, and collaboration are present. Organizations provide context and infrastructure where knowledge creation occurs. Employee involvement is central to both knowledge management and quality management. The biggest challenge in KM is to get employee participation in the knowledge sharing, in order to achieve goals. All employees are responsible for ensuring quality of product or service. Thus, organizational culture must support employee empowerment.

Management commitment plays a major role in both knowledge management and quality systems management. Lack of knowledge and understanding of knowledge management and quality management can lead to the failure of applications.

Adequate technology enables knowledge management. Technology also supports quality systems management by providing the ease in using quality tools. Therefore, organization needs to have adequate technology to support both management systems.

Strong Leadership is needed for both KM and QM. Leadership is required to acquire value from knowledge assets. Management must be actively involved in the quality effort; they should lead by demonstrating, communicating, and reinforcing.

The number of respondents responding to the questionnaires and the availability of interview might limit the study.

Definition of Term

Information: a collection of data that has meaning.

Knowledge: information that is actionable.

Explicit knowledge: technical knowledge; knowledge which we can verbalize and easily capture and store in databases.

Tacit knowledge: based on experience and the skills of know- how, which resides inside each individual. It is an unconventional form of knowledge.

Knowledge Conversion: a dynamic model of knowledge creation anchored to a critical assumption that human knowledge is created and expanded through social interaction between tacit and explicit knowledge.

Knowledge Spiral: Nonaka's spiral of organizational knowledge creation where the interaction between tacit and explicit knowledge will become larger in scale as it moves up to the ontological dimension.

Process: business and production activities of an organization.

Product: the output of any process.

Product Feature: a property of a product.

Product Satisfaction: the feature of a product that responds to customer needs.

Quality Function: the entire collection of activities through which we achieve fitness for use, regardless of where these activities are performed.

Quality Function Deployment: a management tool in which customer expectations are used to drive the design process or to drive improvement in the service industries.

Conformance to specification: conformance to requirements.

Quality Improvement: the reduction of variability in processes and products.

Mission statement: a statement about who we are, who are the customers, what we do, and how we do it. It describes the function of the organization.

Fishbone Diagram: a quality system management tools. This tool is used in searching out the causes of trouble in a process.

Histogram: a snapshot of a group of parts from a manufacturing operation. It shows how a process is operating at a given time.

Control Chart: a record of the results of periodic small inspections.

Control Limits: the boundaries on a control chart within which we can operate safely.

Process Capability: a study analyzes the variation in a dimension caused by all parts of the total process.

Variable Charts: average and range chart.

Attribute Charts: good or bad inspection results.

Chapter 2

Literature Review

In this chapter, the relevant literature for this study is reviewed. Numerous studies on knowledge management and quality systems management in an organization are discussed. The literature review consists of the following subject areas: knowledge creation, knowledge management defined, knowledge as an intellectual asset, knowledge management framework, knowledge management success factors, quality management philosophy and management strategies, similarities and differences between two management approaches, and the link between them.

Knowledge Creating Companies

Organizations deal with uncertain environments through adaptation and interaction. Thus organization views should dynamically cope with the continuously changing environment. The creation of new products and new methods opens a fundamental need to understand how organizations create knowledge that makes such creation possible. Organizations should focus not only on processing information and knowledge but also in the creation of information and knowledge. Take the example of product innovation, it involves not only information processing from inside and outside the organization but also new knowledge creation that takes place. It needs a theory to explain innovation.

Nonaka (1995) emphasizes a need for theory of organizational knowledge creation. According to Nonaka's theory, organizational knowledge creation has two dimensions of knowledge creation: epistemological and ontological. The ontological dimension states that individuals create knowledge. The organization should support the

creation of knowledge by providing the context for individuals to create knowledge. Individual knowledge is then transformed into knowledge at the organizational level through iterative and continuous interaction among individuals. The epistemological dimension states the distinction between tacit and explicit knowledge and emphasizes knowledge conversion between them.

There are four modes of knowledge conversion: socialization (from tacit knowledge to tacit knowledge), externalization (from tacit knowledge to explicit knowledge), combination (from explicit knowledge to explicit knowledge), and internalization (from explicit knowledge to tacit knowledge). Figure 1.1 depicts the four modes of knowledge conversion according to Nonaka (1995).

	Tacit Knowledge to Explicit Knowledge	
Tacit Knowledge From Explicit Knowledge	Socialization	Externalization
	Internalization	Combination

Figure 1.1: Four Modes of Knowledge Conversion

Source: Nonaka, T. (1995). Knowledge Creating Company (p. 72). New York, NY: Oxford University Press, Inc.

Socialization mode is a process of sharing experiences. In this mode, tacit knowledge is created through technical skills acquired from others without using much

language. Technical skills are generated from observation, replication, and put into practice. On the job training is one example of the Socialization Mode where an individual acquires knowledge through observation and practice. Interaction with customers before developing a product is also an example of socialization mode because this process leads to new ideas for improvement.

Externalization Mode is a process of creating new explicit concepts from tacit knowledge. This mode is the key of knowledge creation through the use of metaphor, analogy, and model. Metaphor is a way of perceiving one thing by imagining another thing symbolically. It is based on intuition and holistic imagery. Metaphor creates inconsistency and contradiction. These contradictions and inconsistencies are then synchronized by analogy. Analogy helps harmonize the contradiction by bridging the gap between differences and similarities into a logical model. Once a logical model is constructed, it can be expressed in systematic language and coherent logic.

Combination is a process of systemizing concepts into a knowledge system. In this mode, media such as documents, meetings, networks, etc, are used in combining different bodies of explicit knowledge into one body of knowledge. One of the examples of combination mode is formal education and training at school. Examples of combination mode in the business environment are the organization's vision, business concept, and product concept.

Internalization is a process of embodying explicit knowledge into tacit knowledge. Experiences through socialization, externalization, and combination are internalized into an individual's tacit knowledge in the form of mental models and know-

how or learning by doing. Adequate documentation is necessary for internalization to take place because documentation assists individuals in internalizing their experience.

According to the ontological dimension, an organization cannot create knowledge by itself. The tacit knowledge of the individuals is the basis of organizational knowledge. Thus organizations have to mobilize the individual tacit knowledge. And this is done through four modes of knowledge conversion and crystallized at the ontological level. Thus, organization knowledge process is a spiral process, starting at the individual level and moving up through dynamic interaction into the departmental level and organizational level.

Even though an organization cannot create knowledge by itself, it still plays a major role in knowledge creation by providing the context in which knowledge is created. Furthermore, Nonaka (1995) states that there are five conditions required at the organizational level in knowledge creation: intention, autonomy, fluctuation and creative chaos, redundancy, and requisite variety.

An organization has to have a business strategy that includes knowledge creation. It should include the organization capability to acquire, create, accumulate, and share knowledge. The intention is then expressed in the organization's visions or standards. This vision or standards are used to decide what kind of knowledge should be acquired, evaluated, developed and justified.

The second condition relates to the unexpected opportunities. Employees of the organization should be encouraged to act autonomously. Autonomy leads to the motivation of employees to create new knowledge through unexpected circumstances. It

also increases the flexibility in acquiring and interpreting information. One way for creating an autonomous environment is providing cross functional self organizing teams.

Fluctuation and chaos facilitate the interaction between the organization and the external environment. It creates the opportunity of re-considering and re-questioning ways of thinking and perspective, which forces social interaction that leads to creation of new knowledge. Fluctuation in environments also triggers a break down within the organization, which can also lead to knowledge creation. Chaos increases the tension in the organization and forces its members to define and solve the problem, which can lead to knowledge creation.

Redundancy refers to overlapping of information in the organization. Sharing redundant information promotes the sharing of tacit knowledge. It is not directly related to knowledge creation but it speeds up the process of knowledge creation through interaction among members of the organization.

Requisite variety refers to the organization's internal diversity. The changes in environment require the organization to have the diversity that matches the complexity and the variety of the changes in the environment. Because of the diverse environment, members of organization cannot interact in equal terms. Information is used and exchanged in different terms, which creates the opportunity of new interpretation of information and new knowledge.

In conclusion, Nonaka (1995) introduces an integrated five phase model of the organization knowledge creation process. These five phases are sharing tacit knowledge, creating concepts, justifying concepts, building an archetype, and cross-leveling

knowledge. A knowledge creating organization operates in open systems in which knowledge is frequently exchanged with the outside environment.

What is Knowledge Management?

Before defining knowledge management, let us first review the meaning of knowledge. Lim, Kwang, Ahmed, Pervaiz, & Mohamed (1999) define knowledge as information that is actionable. Turban, McLean, and Wetherbe (2002) defines knowledge as information that is contextual, relevant, and actionable. These definitions of knowledge clearly state that there is a connection between information and knowledge. Knowledge, however, is different from information and it is important to address this difference. Information is a collection of data that has meaning (Lim, Kwang, et al., 1999). Only information that is appropriate, can be put into context, and has the ability to be acted upon is referred to as knowledge.

There are several definitions of knowledge management. O'Dell & Grayson (1998) define knowledge management as a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance. Tiwana (2001) defines knowledge management as the process of managing organizational knowledge for creating business value and sustaining competitive advantage through the creation, communication, and application of knowledge gained from customer interaction to maximize business growth and value. Turban, Mclean, & Wetherbe (2000) define knowledge management as a process that helps organizations identify, select, organize, disseminate, and transfer important information and expertise that are part of the organization's memory and that typically reside within the

organization in an unstructured manner. Clarke & Anthony (2000) define knowledge management as how an organization develops, implements, and maintains its leadership, process, culture, technology, and measurement systems to create, collect, organize, disseminate, and use its organizational knowledge for competitive advantage.

There are two types of knowledge: explicit (knowing what) and tacit (knowing how). Explicit knowledge is based on technical knowledge and can be easily captured and stored in the database. It exists in an organization in the form of manuals, procedures, policies, and other formats, which are in the public domain. Tacit knowledge is based on experience and the skills of know how which reside inside each individual and therefore it is not easily captured and stored in the database. Mostly, tacit knowledge is knowledge that we have, but cannot state. It is unique and very personal to each individual. Below is the comparison of tacit and explicit knowledge based on their characteristics as presented by Tiwana (2001).

Table 1.1: Differences Between Tacit & Explicit Knowledge

Characteristics	Tacit	Explicit
Nature	Personal, context specific	Can be codified & explicated
Formalization	Difficult to codified and formalized	Easily to codified and formalized
Development Process	Trial and error	Understanding and interpretation of information
Location	Individual's mind	Documents, databases,

		charts, reports
Conversion Process	Converted to explicit through externalization that is frequently determined by metaphors and analogy	Converted to tacit knowledge through understanding and absorption
IT Support	Hard to manage and share	Easy to manage and share

Knowledge is never fixed. It is constantly tested, updated, and revised. It continuously grows. Knowledge is an ongoing process. Tiwana (2001) stated that knowledge has three characteristics:

- Experience: mostly knowledge comes from experience.
- Collaborative: new knowledge is created mostly through collaborative processes. In KM we are introduced to a community of practice (COP). COP is a group of people in an organization with a common professional interest (Turban, McLean, et al., 2001).
- Reciprocity: the success of knowledge management depends on knowledge sharing.

Human and organizational cultures are important in knowledge management. Experience comes from what people know, and how what they know can support organizational objectives. Knowledge is created by individuals and/or through collaboration among them. Organizations on the other hand provide context and infrastructure which supports knowledge creation and promotes a sharing culture in implementing KM.

Turban's (2001) model of the knowledge creation process is similar to Nonaka's five- phase model of the organizational knowledge creation process. Turban, Mclean, et al. (2001), imply that knowledge management has six steps in a cycle. Figure 1.2 depicts these six steps.

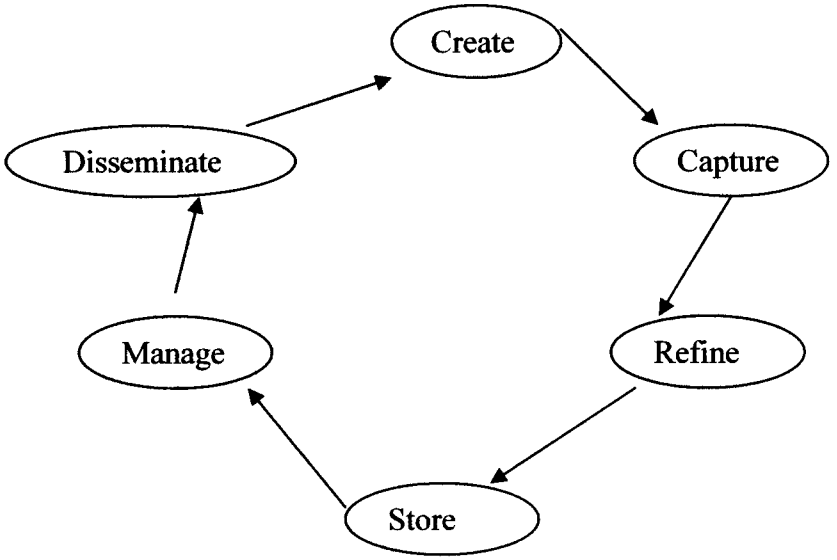

Figure 1.2: Knowledge Management Cycle

Source: Turban, McLean, & Wetherbe. (2001). Information Technology for Management. *Knowledge Management* (pp. 391). New York, NY: John Wiley & Sons.

It starts with the creation of knowledge as people determine and develop know how. New knowledge must have value and can be represented (captured). Once knowledge is identified as valuable, knowledge must be put into context so that it is actionable (refined). Knowledge then should be stored in a repository and reside within an organization (stored). This does not mean that stored knowledge is never retrieved or used again. Stored knowledge should be updated for its accuracy (managed). The final

step is sharing knowledge (disseminate) where anyone in the organization can access organization knowledge.

Van der Spek and Spijkervet (1997) distinguish the following specific areas of knowledge management that relate to the life cycle of knowledge areas within an organization. Those areas are:

1. Promising Knowledge Areas. These are still in their infancy but have demonstrated to have potential to radically change the organization.
2. Key Knowledge Areas. These areas distinguish one enterprise from another and relate to the unique core competencies.
3. Basic Knowledge Areas. These are essential for carrying out the activities of an organization.
4. Outdated Knowledge Areas. Limited to no effect on a successful organization.
5. Critical Knowledge Areas. These areas of knowledge are vital to an organization prosperity and growth. They enhance improvement, efficiency, effectiveness and provide opportunities to enter new markets.

Unfortunately, the most common approach to KM in the market is the technology approach. The most important factors, however, in KM are people because they own the majority of the knowledge. Thus KM can be managed without technology. On the other hand, it is not an easy task to manage and transfer KM without technology. Technology is not the driver of KM but technology is an enabler for KM and technology acts as a catalyst for the emergence of KM. Aligning KM and Technology leads to effective knowledge management.

Knowledge as Intellectual Asset

An organization cannot operate unless managed by people. The organization's human resources is the factor that will make the organization survive or fail. The employees' knowledge determines the way the organization is managed. Thus knowledge is an asset. Because knowledge is linked to almost all functions in the organization, knowledge has become an intellectual asset in determining the life of an organization.

According to Wilson et al. (1999) knowledge asset is the codification of human expertise. This asset creates value to organizations because it provides guidance for decision making, promotes understanding, and creates new knowledge on how organization adapt to changes. In fact, the process of creating knowledge assets is the fundamental activity of corporate memory. Thus this asset needs to be managed.

According to Jerry Ash (2002), since the mid 1990s, 80% of organizations' assets reside in their intellectual assets and the majority of these assets are tacit. Most organizations now realize that their worth resides not in what they own but in what they know. Unfortunately the accounting process does not account for this asset. The characteristic of knowledge that is intangible makes it harder to measure, nevertheless because knowledge is an asset, it must be held accountable.

Knowledge Management Framework

Few studies have been done in developing a framework of knowledge management. In addition, none of those studies of knowledge management framework can provide a complete frame for knowledge management. This happens because knowledge management can be viewed differently according to one's background and

interests. Generally, a knowledge management framework should consist of the understanding on various components of KM so that a framework provides a unified view of knowledge management. Therefore a framework is essential to study KM in an organized way as well as to measure the current state of knowledge management.

Dr. Michael Stankosky (1999) has developed the model of "four pillars of influence within an organization" which affect overall performance and are the foundational architecture for KM. These four pillars are technology, learning, organization, and leadership.

Technology is the enabler and provides the entire infrastructure and tools to support enterprise. The organization structure must support and interface with the overall strategy. Knowledge creation and sharing must be supported by the organization. Leadership drives the value of knowledge management throughout an organization. A positive impact from lessons learned must be built by managing information to build organization knowledge.

Choo (1998) introduced three processes as building blocks for knowledge management framework: sense making, knowledge creation, and decision making. These three processes are interconnected activities that generate an organization's information which lead to the bases of knowledge. The sense making identified how information and knowledge are disseminated based on the understanding of environmental changes. The knowledge creation phase is concerned with how collected information is transformed to create new knowledge. The decision making phase is concerned with analyzing and selecting knowledge based on available information to form a knowledge creation phase that resolves task uncertainty.

Because there is no universal knowledge management framework that fits into every type of organization, the organization can develop different factors for its own knowledge management framework.

Knowledge Management Success Factors

Similar to knowledge management framework, there have been no universal factors that clearly define the knowledge management success factors. The proposed success factors are too fragmented and diversified. The critical success factor analysis however is useful for structuring environmental analysis because there is an important link between them, which leads to organizational success. The critical success factor analysis provides an important meaning to knowledge management through the identification of core processes that are critical in knowledge management implementation. Therefore, an organization needs to identify critical performance indicators of success factors. However, those success factors should be aligned with the goals of an organization.

There are numerous findings which examine the main sources that can be used to identify the critical success factors of knowledge management. Allee (1997) identified twelve knowledge management principles that can be used as a common guideline to define success factors. Those factors are:

- Knowledge cannot be isolated or analyzed out of context;
- Knowledge is self organizing;
- Knowledge seeks community;
- Knowledge is acquired and transmitted through language;
- Codifying knowledge could limit one's creativity;

- Knowledge should not be put under tight controlled;
- Managing knowledge requiring constant change;
- Old ways of thinking prevents knowledge growth;
- Knowledge is a social process;
- Removes any organizational constraints;
- No one best practices to advance knowledge;
- How knowledge is defined affects knowledge management.

A study done by Davenport, et al. (1998) identified eight key success factors. They are:

- Technology infrastructure;
- Organizational infrastructures including human resources;
- Flexibility, evolution, and ease of accessibility to knowledge;
- Shared knowledge;
- Supports organizational culture;
- Motivated worker in use, develop and share knowledge;
- Knowledge transfer;
- Management support and commitment.

Madanmohan (2002) identified eight successful factors based on the "8 Cs" framework. The following is the brief evaluation of the eight factors:

1. Connectivity. Technology is an essential enabler to build knowledge infrastructure that supports the use of knowledge sharing. It should be easy to administered and used.

2. Content. Start by conducting organization's knowledge audit to determine internal and external knowledge leverage points. The audit aims to align the objective and assists in choosing appropriate KM approach that matches organization's knowledge capability. It ensures workflow design for valuable content, easy navigation, and easy retrieval.
3. Community. Knowledge management relies on group of people known as community of practice (COP). This people must work across organizational boundaries.
4. Culture. Organization needs knowledge and learning culture at multiple level because learning assists and reframes existing knowledge. Top management has to support open and trust environment, making the vision to be known.
5. Cooperation. Cooperation is necessary to remove any barriers.
6. Capacity. An organization has to have capacity to build knowledge management strategy. The role of knowledge management must be clearly defined.
7. Commerce. Capable to adapt to changes.
8. Capital. Adequate capital investment is required. Return on Investment (ROI) can be used to measure financial performance.

Hariharun (2002) identified four classes of KM success factors. They are:

1. Technology. It is a key enabler that supports documentation, collaboration, workflow and knowledge sharing. One of the KM technologies is the knowledge portal on the corporate intranet.

2. Processes. Refers to standard processes that are clear, simple, and easily understood by employees. It includes content management, community of practices, knowledge contribution, etc.
3. People. Employee participation is critical in knowledge sharing. Knowledge must be visible and accessible so that it can be reached the right people at the right time.
4. Sustained strategic commitment. Top management provides sustained strategic commitment. Effective communication is needed.

In conclusion, knowledge management means management of organizational knowledge by converting it's the organization's assets into real business value aimed at generating a competitive advantage. Knowledge management enhances an organization's survival and success through its capacity in creating, acquiring, sharing and utilizing organization knowledge.

There are three characteristics that determine the success of KM: The objective must be visible, the context must be available, and the knowledge must be visible and accessible. An organization has to choose the most appropriate KM approach that matches the organization's knowledge capability.

Quality Management

Every organization implements and uses quality principles and tools in its operations. Quality is one important factor to customers in determining which products or services to buy or use. Quality has become one of the major management tools and techniques since the 1980s. There are several major approaches to quality presented by quality gurus (i.e., Deming, Juran, Crosby et al.) and quality principles and practices

(e.g., total quality management (TQM), ISO 9000, lean manufacturing, Just-in -Time and six sigma). Even though quality management tools may be used in different industries, they have similarities, which will be discussed later in this study.

Juran (1988) stated that quality has several meanings due to the differences in customers' and suppliers' viewpoints; however, there are two definitions of quality that stand out. The first definition is that "quality consists of those product features which meet the needs of customers and thereby provide product satisfaction" (Juran, 1988, p. 2.2). The second definition is that "quality consists of freedom from deficiencies" (Juran, 1988, p. 2.2). In general, customers view quality in terms of the features of the product that respond to their needs and that the product is free from deficiencies. From an organization point of view, product features affect income from sales and product free of deficiencies affects cost. The two quality definitions can then be combined into one definition "Fitness for use" (Juran, 1988, p. 3.6). Products and/or services are produced through a series of activities. In an organization several functional departments perform those activities. Consequently, each department is responsible to assure that the work is done correctly. Thus each department has quality activity. The collection of those activities is called quality function.

Changing business environment is the main influence in implementing quality. Generally, there are four forces that drive organizations towards quality improvement: raising of customers' expectation, globalization & competition, high cost of waste or poor quality, and rapid change in business.

Higher levels of customer expectation are driven by competition. It can take several different forms such as the quality of service before and after sale, low product

variability, whether or not the product meets its specifications, reliability of the product, etc. Globalization triggers competition from foreign organizations, consequently the market becomes more competitive. Quality is one weapon organizations use to stay competitive. In the past, high quality meant high price, however, today's quality and prices go hand in hand. Competition forces organizations to remain innovative not only to improve quality of the product but also to lower the production cost. Higher cost of waste or poor quality can be very expensive. Mass inspection does not guarantee product quality. Building quality and improving the process into the product from the beginning prevents waste and decreases the cost of poor quality. Rapid change in the business environment forces organizations to implement new management techniques to remain relevant and competitive in a rapidly changing business world.

The quality of a product or service can be evaluated in several ways based on the dimensions of quality. Quality has eight dimensions (Besterfield, Michna, & Sacre, 2003) as follow:

1. Performance (primary characteristics);
2. Features (secondary characteristics);
3. Reliability (consistency of performance over time);
4. Durability (useful life);
5. Serviceability (ease of repair);
6. Aesthetics (sensory characteristics);
7. Reputation (past performance);
8. Conformance to standards (meeting specification).

In addition, quality has three characteristics: physical (length, weight, voltage, viscosity),sensory (taste, appearance, color), and time orientation (reliability, durability, serviceability).

There are two types of customer under quality systems management: internal customer and external customer. An internal customer is a member of an organization, but not organization's client. Internal customers can be a department or persons that receive products and/or services from other departments or a person within the organization. An external customer is a person impacted by the product.

Quality Philosophy and Management Strategies. According to Dr. Deming (Besterfield et al., 2003), the meaning of quality is relative because consumers define quality. He believed that quality is the responsibility of organizational management. Thus quality needs management action. He introduced 14 principles for implementing quality known as Deming Principles. Overall, these 14 points stressed the need to change and that management needs to commit and facilitate this change. These 14 principles of quality management are:

1. Generate consistency of purpose for the improvement of product and service, with the intent to become competitive, stay in business, and provide jobs.
2. Adopt the new philosophy of cooperation in which everybody wins. Teach this philosophy to employees, customers, and suppliers and put it into practice.
3. Do not depend on mass inspection to attain quality. Build quality through process improvement from the beginning.
4. Stop awarding business on the basis of price alone. Build long term relationship with single supplier based on trust and loyalty.

5. Constantly improve the system of production, service, and planning.
6. Institute training for skills.
7. Institute leadership for the management of people, recognizing their different abilities, capabilities, and aspirations. The intent is to assist people, machines, and gadgets to do better job.
8. Drive out fear from employees.
9. Break down barriers between functional departments.
10. Eliminate slogan, exhortations, and targets asking for zero defect.
11. Eliminate numerical goals, quotas, and management by objectives.
12. Remove barriers that prevent people from doing their work.
13. Institute education and self improvement program.
14. Everybody in the organization is put to work to accomplish the transformation. Get management commitment.

Dr. Deming introduced plan-do-study-act cycle (PDSA Cycle) as a continuous process improvement framework. The figure below depicts Deming's PDSA Cycle.

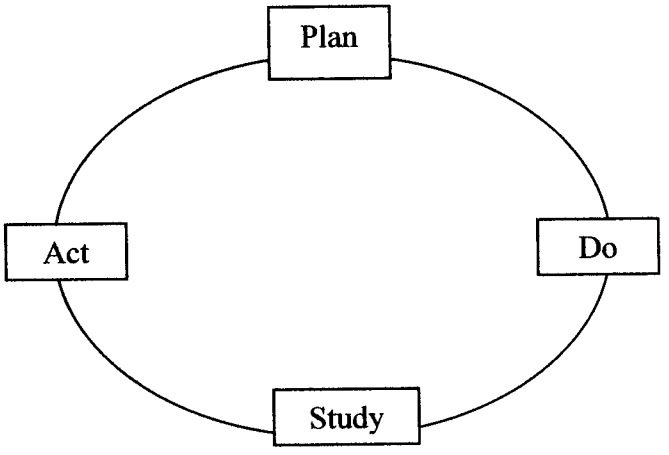

Figure 1.3: Deming's PDSA Cycle

Sources: Besterfield, et al. (2003). Total Quality Management. Upper Saddle River, NJ: Prentice Hall, Pearson Education Inc.

The first stage is to plan carefully what is to be done before carrying out the plan, then implement the plan. Study the plan to determine whether or not the plan works as intended, if not, find out what went wrong. The last stage is to act on the results by identifying what worked and what didn't. Then use the knowledge learned to develop a new plan and repeat the cycle.

He also emphasizes statistical methods in quality improvement. There are three major statistical methods for quality control and improvement: statistical process control (SPC), Design of Experiment (DOE), and acceptance sampling. SPC is an on-line quality control tool where control charts are used for monitoring processes and reducing variability. DOE is an approach to systematically varying the controllable input factors in the process and determine the effect these factors have on the output responses. DOE is very important for variability reduction. Acceptance sampling is the inspection and classification of a sample of the product selected at random from a larger batch or lot and the ultimate decision about disposition of the lot. There are two types of inspection under acceptance sampling: outgoing inspection and incoming inspection.

According to Dr. Juran (1951) quality should be managed the same way as three managerial processes: planning, control, and improvement. He introduces the trilogy of quality management: quality planning, quality control, and quality improvement.

Quality planning emphasizes developing products and processes to achieve goals, which meet customers' needs. It involves several common steps:

- Determine who the customers are.

- Determine customer needs.
- Develop product features to accommodate those needs.
- Develop processes to produce those features.
- Transfer the resulting plans to the operation.

Once planning is complete and transferred into operation quality control should be directed towards meeting goals and preventing error/waste. It is based on feedback loop, and involves the following steps:

- Evaluate actual operating performance.
- Compare actual performance to goals.
- Act on differences.

Quality Improvement is directed to attain the level of performance that is better than the previous level. It aims at improving the fitness for use and reducing cost of poor quality. Improving fitness for use can provide better quality for the users, better reputation in the market, etc. Reducing cost associated with poor quality lowers costs and improves productivity. Dr. Juran states that quality improvement can be achieved through "managerial breakthrough" by following a problem-solving process.

Dr. Cosby (Besterfield et al., 2003) emphasizes the conformance to requirements. The method of measurement must be established. According to him, the cost of quality equals the price of conformance (POC) and the price of non-conformance (NPOC). Cosby points out the importance of doing it right the first time is less expensive than the costs of detecting and correcting nonconformities. Doing it right the first time also prevents waste. The prevention process involves thinking, planning, and analyzing. Cosby (1984) introduced four absolutes of quality management: conformance to

requirements, emphasis on prevention, zero defect performance standards, and lower price of non-conformance as the measurement of quality.

Total Quality Management (TQM) is a top-down management system consisting of values, methods and tools aimed towards continually improving all the processes of the organization to increase customer satisfaction with a reduced amount of resources. The TQM approach to quality is closely related to Dr. Deming's approach with strong emphasis on prevention, statistical control method, and the role of leadership. Managers play a key role in implementation and cultural change. The values in TQM are: focus on customers (internal and external), focus on processes, decision based on facts, everybody commitment, continuous improvement, and top management commitment. These values shape the organizational culture that should be supported by proper methods and tools. TQM stresses the use of knowledge, control, and the continual improvement of skills, and improvement through standards and benchmarking. The figure below depicts the TQM documentation levels according to Firestone (1989).

Level I: Manual
Mission Statement, Policy Statement, Business Plan
Level II: Procedures
Policy, What, Who, Where
Level III: Written Instructions
Detailed Policy
Level IV: Databases, Forms, Books
Documentary evidence of performance

Figure 1.4: TQM Documentation System

According to Besterfield et al., (2003), TQM requires six basic concepts:

1. Management commitment and involvement in providing long-term support.
2. Focus on both internal and external customer.
3. Effective utilization of the entire work force.
4. Continuous improvement.
5. Long- term partnership relations with supplier.
6. Performance measurement for the processes.

The six sigma approach began in 1980 at Motorola. It was used as the internal quality improvement plan. With six sigma, Motorola successfully increased its profit by 20% each year with cumulative savings of $US 14 Billion. As a result, Motorola became the first winner of America's Malcolm Baldridge National Quality Award in 1988. Since then the six sigma approach has grown into a multibillion dollar effort adopted by many world-class companies such us General Electric, Allied Signal (Honeywell), Lockheed Martin, Polaroid, Sony, Honda, Ford, American Express, and others. Six-sigma focuses on reducing waste, cycle time, defects, and non-value added activity. The goal is error-free performance

Klefsjo, Bengt, Wiklund, and Edgement (2001) define six sigma as an application of statistical technique in an innovative manner that has achieved acceptance, use and results by the management of organizations. The name "sigma" is related to a statistical measure to the capability of the process. It is the ability to produce non-defective products. The six-sigma approach is intended to reduce process variation in the processes of the organization as well as the variation of that obtained from an organization's suppliers. And therefore six sigma principles do not contain anything new because of its

focus on processes and variations. These two factors are also the key to quality control and can be found at Deming and Shewhart's works. Design of experiments and statistical process control are two statistical quality control tools that are used by six sigma programs.

The key element of six-sigma is that performance is measured by the sigma level measure of variability in an organization's business process. Harry and Schroeder (Besterfields et al., 2003) use a method of a define-measure-analyze-improve-control model (DMAIC) for the six sigma concept. The elements of DMAIC are:

- Define goals
- Measure existing system and processes
- Analyze using statistical analysis (SPC)
- Improve system using statistical method
- Control new system

Other key elements include establishing close communications with customers, employees, and suppliers, incorporating comprehensive training in using statistical tools and techniques, and applying continuous process improvement.

Six sigma approaches differ from company to company, however, they do have some common features:

- It is a top-down, rather than bottom –up approach.
- It is a highly disciplined approach that typically includes four stages: measure, analyze, improve, and control.
- It is a data oriented approach, making sound and heavy use of various statistical decision tools.

Even though six sigma concepts have gained recognition as one of the quality approaches, six sigma does have a drawback. It is difficult to implement six sigma in small organizations and the implementation is not cost effective. Even medium sized organization may also have cost effective issues.

ISO 9000 is a standard adopted by the International Organization for Standardization (ISO). Since its introduction in 1987, ISO 9000 has gained worldwide recognition as the standard for quality systems. The standards consist of comprehensive quality management concepts and guidelines. ISO 9000 includes quality planning, quality control, quality assurance and quality improvement. It focuses on the customer, leadership, employee involvement, process approach, continuous improvement, decision-making process, and supplier relationship. The certification, however, is attainable through third party, known as registrar. It is an assessment and audit of an organization's quality system.

Many organizations perceive the certification as a tool for improving their market position. They began to attain certification as a part of their marketing strategy. One of these strategies is to stay competitive in the market especially if they want to compete in the global market. They have learned how to use quality as a competitive weapon to increase market share and to improve business performance. However, they also recognized that quality can only be achieved through the establishment of steady management systems within their organizations.

Quality Cost. All organizations identify the costs needed to carry out their operation, including quality cost. The term quality cost refers to the cost of poor quality which is all costs that are associated with products that do not meet requirements. It

covers a collection of costs that are incurred by many departments in an organization. According to Dr. Juran (1984) the objectives of evaluating quality costs are as follows:

1. Quantify the size of the quality problem in language that will have impact on upper management.
2. Identify major opportunities for cost reduction.
3. Identify opportunities for reducing customer dissatisfaction.
4. Expand budgetary control and cost control.
5. The publication of cost data will stimulate managers to take action to reduce the cost.

Quality cost is divided into four categories: prevention costs, appraisal costs, internal failure costs, and external failure costs.

Improvement in quality can lead directly to increased productivity. They both move in synergy and result in cost reduction.

Commonalities in Quality Management Approach. Although there are several approaches to quality, those approaches have some similarities. Firestone (2002) points out those similarities:

- They tend to view quality in terms of value produced by business processes and customers.
- Quality can be achieved through process control.
- Take system approach.
- Call attention to scientific approaches, statistical analysis, and knowledge processing.
- Underline the importance of measurement method.

- View quality management as an integrated set of activities designed to have a direct impact on all business processes.
- Technology as key enabler.
- Emphasize prevention of error and cause and effect analysis.
- Underline the role of management (leadership).
- Organizational learning framework through PDSA cycle.

The following are the most common steps on how quality is accomplished in organizations:

1. Develop a quality management system.
   - Document mission statement, goals, and objective.
2. Do a quality function deployment (QFD) to determine appropriate processes and capabilities.
3. Investigate the process.
   - Do Fishbone Chart to assign sources of variation.
   - Determine whether parts or products are normally distributed with histograms or frequency distributions.
   - Determine central tendency.
4. Do a process capability (Cp) or (Cpk) to determine if an organization can make the product the way the customer wants it while developing natural specification and control limits.
5. Do variable charting once the processes are going to determine whether or not the process is in control
   - X bar charts & R charts.

6. Do attribute charting to determine the level of defective products.
   - P Charts, np charts, c chart, and u chart.
7. Use MIL 105 STD for shipping and receiving. It is done to control materials coming into and out of the plant.

Similarities of QM & KM Approaches.

There are several similarities between QM and KM. KM and QM focus on the importance of leadership and its role. Communication and collaboration are important for creating knowledge and developing quality.

Employee involvement is central in both management systems. Empowerment of the workforce is central to QM. The success of empowerment, however, depends on the employees' knowledge about their work and organization values.

KM and QM support and facilitate best practice transfer into an organization. They rely upon a structured approach to transfer the best practices that cater to the formal and informal way that things get done (Cross, 2002).

They both have similar organizational learning frameworks. For quality it is PDSA cycle and for KM it is the cycle of creating knowledge. "Plan" (from PDSA) can be aligned with creating and capturing knowledge. "Do" (from PDSA) can be aligned with refining and storing knowledge. "Study" (from PDSA) can be aligned with managing knowledge, and "act" (from PDSA) can be aligned to sharing and using of knowledge.

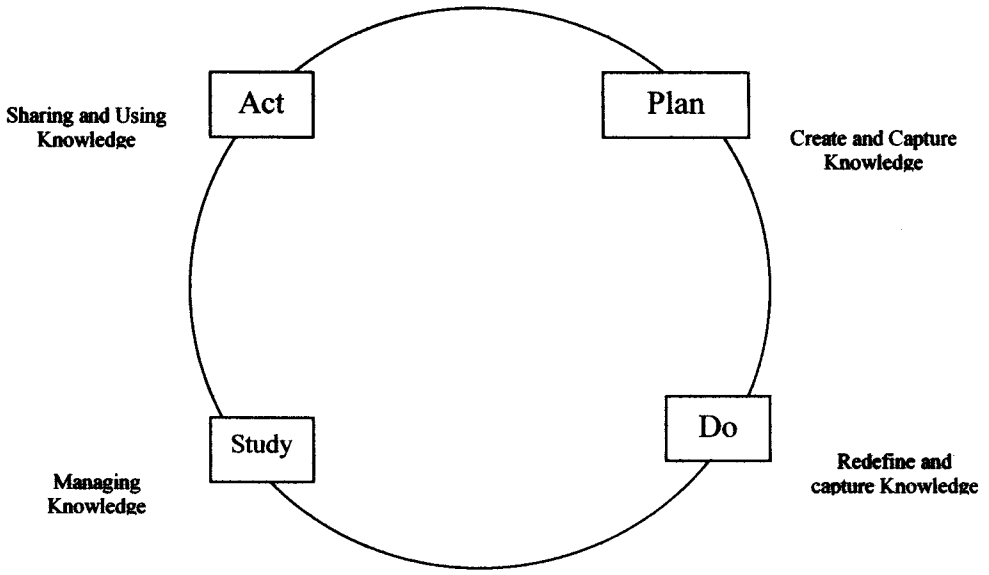

Figure 1.4: Similar Framework

KM & QM use Information Technology tools and techniques to support individuals and organizations in achieving their goals.

The end result of KM and QM is to transform the organization's assets into real values.

Differences of QM & KM Approaches

The purpose of knowledge management is to design and develop knowledge processes to see how the knowledge can be re-used in the future. KM is a more holistic approach to managing knowledge of the organization. It might not specifically take care of the products itself, however, it provides an environment for a good QM system to be institutionalized.

KM is less focused on controlling processes such as manufacturing, and quality has more focus on such processes as preventing errors.

QM certainly was bringing change in the early 1980s during the era of manufacturing economy but with the emergence of digital economy, especially Internet

in the nineties, opportunity for a new type of enterprise emerged. QM is not challenging to the status quo but has become the status quo by itself. Knowledge management on the other hand presents unforeseen options and additional challenges to how organizations work. KM provides a broader perspective with the ability to question how things get done and why.

QM focuses on the process driven. It is a more universal solution for every organization, however, not all organizations have the same processes and they may differ every time they are applied. KM is not dependent upon process driven operations and knowledge management can be viewed differently based upon one's background and interests.

QM relies on measurement while KM is intangible and therefore in many ways is un-measurable.

Linking KM & QM

Quality management does not involve managing knowledge directly. QM, however, involves knowledge production and therefore, QM can be directed at improving the quality of the knowledge processes: knowledge production. Quality management relates and has an impact on any business process including KM.

Quality management focuses on performing knowledge processing in order to decide how to manage business processes in order to produce quality products or services. Knowledge management focuses on managing knowledge processing in order to accelerate innovation to solve problems in business processing.

Knowledge management provides essential information to employees to make a better decision which leads to continuous improvement in quality management. Quality

system management on the other hand helps determine the quality of information in a knowledge repository and stimulate effective communication that enables the sharing of knowledge.

Under quality management, process improvement focuses on action. Knowledge management promotes process enhancement through supporting individual and organization performance. By enhancing the process and supporting the organization's performance, KM can optimize the continuous improvement of an organization.

Quality relies on knowledge production to bring scientific, systematic, and statistical studies on quality in organizations. In other words quality can use knowledge management as a source in building quality. The diagram below depicts the relationship between KM & QM.

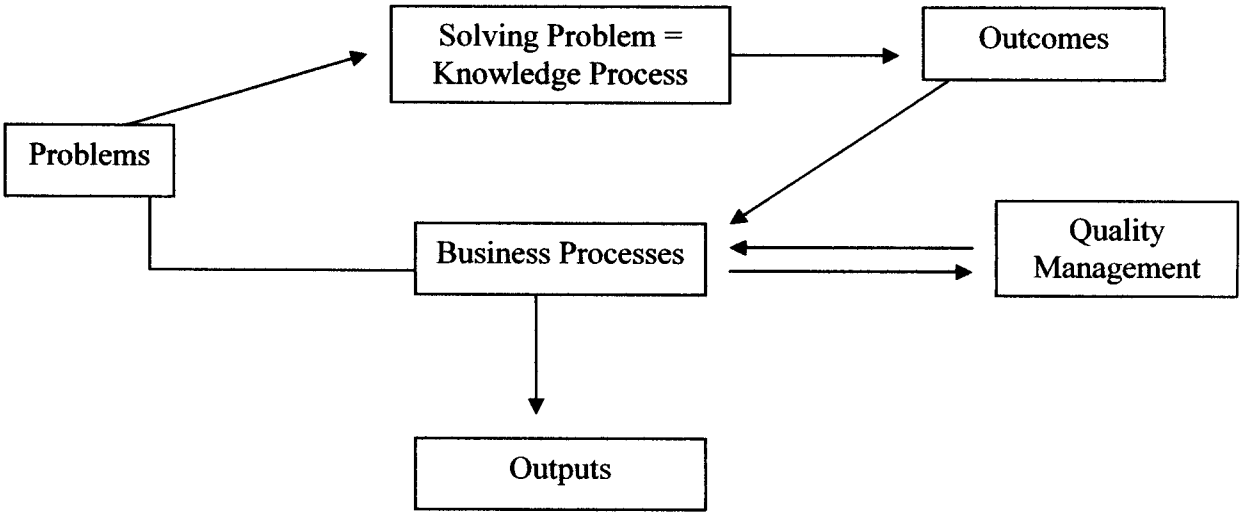

Figure 1. 5: Relationship between KM & QM

In conclusion, QM and KM are complementary and equally necessary in their respective areas of strength. QM impacts in business processes are direct, while the KM impact on business processes is indirect or direct. Both are needed and they can

complement each other (e.g., KM deals more with creativity and innovation, but QM is needed in order to manifest innovation into products or services). QM can use knowledge in improving its quality such as following best practices.

Summary of Literature Review

Throughout this chapter, definitions of knowledge and knowledge management, knowledge creating company, various knowledge management elements, knowledge management frameworks, critical success factors of knowledge management, definition of quality, quality management philosophies, quality management strategies, and others quality elements are reviewed.

The review and evaluation of the literature in the previous sections have revealed some similarities and differences between knowledge management and quality management as well as shown links between them. One of the major relationships between KM and QM is in the business processes of an organization as presented at figure 1.5. On one hand knowledge management itself is a process that impacts all business processes. On the other hand management of knowledge is intended to improve business processes. So it can be said that knowledge management implementation in managing quality enhances and sharpens the quality of the business process. Quality is more technical and directly deals with product and services while knowledge management relates to the critical issues of organizational adoption, survival and competence in the face of increasingly discontinuous environmental change.

Today business is looking for not only efficiency but also growth. Efficiency is leaning toward QM while growth is leaning toward KM. Thus both management systems are needed.

Chapter 3

Research Method

From the literature studies, many important factors contributing to the successful implementation of knowledge management in organizations have been identified. In chapter two it was noted that human resource plays a key role in successful knowledge management implementation. An organization provides appropriate context and infrastructure for knowledge creation and that technology is the key enabler for knowledge management. This study will focus on measuring these three factors to determine the application of knowledge management used for managing quality systems in an organization.

Human resource plays a key role in successful knowledge management implementation. Three issues can be used to determine the application of knowledge management in this area (i.e., training, employee involvement, and team work). These factors are also keys in managing quality. Employees need to be trained in order to input items in the knowledge repository, as information has to be presented in standardized fashion. Employees need to know how the sharing of knowledge benefits them. Successful knowledge creation and sharing activities and processes, which lead to higher customer satisfaction, are not possible without appropriate training. Thus, timely and appropriate employee training is one of the key success factors.

Business and knowledge management application focuses on providing an environment in which knowledge workers from various disciplines can come together and create new knowledge. Employee involvement allows the gathering of knowledge from various levels of management. In addition, employee involvement also supports the

transfer of best practice into an organization. Because employees must share the nature of knowledge creation and knowledge sharing, many knowledge management activities and applications focus on employee involvement.

Teams are replacing individuals as the basic building blocks of organizations. Team-working an organization assists in enhancing knowledge management. Community of Practice (COP) in knowledge management is a form of peer-to-peer collaboration that allows the comprehensive flow of knowledge. Creating a team allows organizations to apply diverse knowledge, skills, and experiences towards its processes and problem solving. In addition, team work also promotes creativity. The spirit of teamwork that is based on care, respect, trust and sharing is an essential factor for successful implementation of knowledge management.

Organization culture and leadership play a key role in the implementation of knowledge management. Due to unpredictable market conditions, organizations need to learn continuously to adapt to the internal and external business environment. The organization must be organized to support the values of knowledge creation and sharing. Leadership develops strategy that drives the value of knowledge management throughout an organization. Organization structure plays a significant role in managing knowledge effectively and efficiently. Flat and decentralized organizational structure is more supportive in managing knowledge.

Information technology infrastructure must support knowledge management applications. It is also essential that information technology be aligned with the business strategy of an organization. In general, information technology that contributes most to knowledge management applications are internet and intranet access, relational

databases, text and document search engines, groupware, data warehouses, data mining, document management, web site content management, corporate portal, and knowledge portal.

Participants

Participants in this study were selected from manufacturing organizations in Coles and Effingham counties located in Central Illinois as identified according to 2005 Illinois manufacturing directory published by Manufacturing News, Inc (MNI). The number of employees and the annual sales revenue are used as parameters to identify the participants. All manufacturing organizations that have 15 to 200 employees and have sales revenue of at least one million dollars were included in the population from which the participants were selected.

There are fifty- eight manufacturing organizations that have employees and sales revenue that match the parameters; twenty-five will be selected for this study. The twenty-five participants will be chosen using convenience sampling. The survey questionnaire will be sent to the person in charge of managing quality of organizations.

The survey questionnaire

The questionnaire was developed based on the implementation of knowledge management and quality management factors identified in the previous paragraph. For this purpose, a questionnaire with four sections was developed to collect relevant information. The first section contains ten questions on organizational demographics.

The second section consists of twelve questions. Questions were designed to acquire information related to important factors affecting the implementation of quality management based on ISO 9000 criteria. An ordinal scale was used where the items in

the survey ask the respondents to indicate the level of importance and implementation of each factor using a four-point Likert scale. An example of the format is shown below:

1 = Not Important

2 = Minor Importance

3 = Important

4 = Very Important

Therefore, higher values indicate higher levels of importance and more extensive implementation of knowledge management.

Section three consists of eight statements asking respondents to state their agreement/disagreement on the current issues of knowledge sharing and knowledge management. Each section will be scored using four point Likert scale. An example of the format follows:

1 = Strongly Disagree

2 = Disagree

3 = Agree

4 = Strongly Agree

Responses will be coded in such a way that higher values indicated higher levels of agreement.

Section four was designed to elicit the respondents' opinions on how knowledge sharing and management in general contributes to organizational competitiveness in the business environment. There are seven questions in this section. Using a five-point Likert scale, the example of the format is illustrated below:

1 = Strongly Disagree

2 = Disagree

3 = Agree

4 = Strongly Agree

Responses will be coded in such a way that higher values indicated higher levels of agreement.

The validity was verified through pilot testing the questionnaire to students in research in technology class (Fall 2005) as well as faculty members of school of technology.

The quantitative-descriptive research method was adopted. The quantitative element of the research is related to the use of numbers (statistics) to describe characteristics of the respondent group. The descriptive statistics and analysis used to measure respondent feedback and to determine variances between groups includes: mean, median, mode, range and standard deviation. The report was made using descriptive statistics.

Chapter 4

Results and Discussions

The selected manufacturing firms consist of 25 manufacturing organizations in Coles and Effingham counties located in Central Illinois as identified according to 2005 Illinois manufacturing directory published by Manufacturing News, Inc (MNI). Email and phone calls were used to ensure the questionnaires would be returned. Nine questionnaires were returned and received. A summary of demographic characteristics of respondents is shown in table 1.2.

Table 1.2: Summary of Demographic Characteristics

Characteristic	**Response**
Job Title	President, Vice President, Director, Production Manager, Operation Manager, Site Manager, Human Resources Administrator
Years in current position	3 – 8 years
Years of employment	6 – 28 years
Number of employees in department	2 – 140 employees
Number of employees in location	20 – 210 employees
Member of ASQ	none
ISO Certification	4
Knowledge Management Software	Power way, Right now yes
Quality Information Center	5

Most of the respondents identified Internet, intranet, & search engines as the three major technology components that contribute to knowledge sharing. A summary of technology components that significantly contribute to knowledge sharing is presented in table 1.3.

Table 1.3: Technology Components Contribute to Knowledge Sharing

Internet & Intranet	7	Groupware	2
Corporate Portal	1	Data Warehouses	1
Relational Databases	3	Data Mining	1
Text & Document Search Engines	5	Website Content Management	2

The second part of questionnaire was designed to acquire information in the implementation of quality system management according to ISO 9000 criteria as follows: training, education & self improvement, communication, leadership, teamwork, long term partnership, and continuous improvement. The results are presented in table 1.4. It can be inferred from the returned questionnaires that all of the manufacturing organizations regard the elements of quality management systems as important and that knowledge sharing contributes to producing quality products/services as well as to improving the production process. More than half identified teamwork as a tool that promotes the application of knowledge sharing where diverse experience and knowledge are shared among the employees.

Table 1.4A: QM & KM Application

Statement	Not Important (%)	Minor Important (%)	Important (%)	Very Important (%)
Organization's strategy and goals are included in employee's training program.	0.00	11.10	33.30	55.60
Inclusion of knowledge performance in employee performance appraisal	0.00	11.10	44.40	44.40
Clear and timely communication by management.	0.00	0.00	33.30	66.70
Employee participation in the decision making process.	0.00	11.10	66.70	22.20
Discussion groups & benchmarking.	11.10	0.00	88.90	0.00
Formal and informal feedback obtained from managers to employees and employees to management.	0.00	11.10	33.30	55.60
Standard processes for knowledge contribution and retrieval of information have to be as clear and simple as possible and well-understood by employees across the organization.	11.10	11.10	55.60	22.20
Employee teams for the application of diverse knowledge, skills, and experiences.	0.00	33.30	55.60	11.10
Employee recognition for their contributions to the department /organization.	0.00	22.20	44.40	33.30
Virtually distributed existing knowledge into other parts, departments, and locations of the company so that information that might be relevant in near-term decisions can be reach the right people a head of time.	0.00	22.20	44.40	33.30
Embedding knowledge in products, services, and processes assists in delivering higher-quality, individualized offerings that secure customers.	0.00	33.30	33.30	33.30
Suppliers are treated as a strategic business partner on long term basis.	0.00	44.40	22.20	33.30

Table 1.4B: QM & KM Application

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Mean	3.44	3.33	3.67	3.11	2.78	3.44	2.89	2.78	3.11	3.11	3.00	2.89
Median	4.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00
Mode	4	3	4	3	3	4	3	3	3	3	2	2
Std. Dev	.726	.707	.500	.601	.667	.726	.938	.667	.782	.782	.866	.928
Range	2	2	1	2	2	2	3	2	2	2	2	2

An average between 3.4 to 3.6 for question 1, 3 and 6 confirmed that the respondents see a training program as a main channel for introducing the organization's strategy and goals. Communication and feedback are important in organizations. There is very little variance among respondents since the standard deviation is below zero. However the respondents tend to vary in their opinion that suppliers are strategic business partners (std = 0.928) and that standard process for knowledge contribution and retrieval information should be stated clearly (std = 0.938).

The third part of questionnaire was designed to explore the respondents' opinion on whether or not they agree or disagree on the current issues of knowledge sharing. All respondents agreed to some extent that employees are required to share what they learned. This is a strong basis in sharing and preserving knowledge in a company knowledge repository. However, most of the respondent's responses varied regarding whether knowledge sharing should be included in an organization's culture.

Table 1.5: Knowledge Sharing

Statement	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)
Employees are encouraged to share with others what they learned from their recent assignments.	0.00	0.00	44.40	55.60
Employees are required to share with others what they learned from their recent assignments.	0.00	44.40	55.60	0.00
Senior staff can not share their work related experiences due to busy schedules.	0.00	55.60	44.40	0.00
The department has a well-organized system for sharing knowledge (e.g., regular training sessions, employee presentations on various projects) within departments or practice areas.	0.00	44.40	55.60	0.00
The department has a well-organized system for sharing knowledge across departments or practice areas (e.g., cross departmental presentations).	0.00	55.60	44.40	0.00
There is an expectation that employees or employee teams will regularly share reflections on learning experiences with other employees in the same department/organization.	0.00	44.40	22.20	33.30
Experiences of employees are available in retrievable format	22.20	44.40	22.20	11.10
Sharing knowledge systematically is part of the firm's culture.	11.10	55.60	22.20	11.10

Two of the research questions of this study focused on exploring the possibility that the application of knowledge management supports quality management to provide competitive advantage in organizations. Thus, the fourth part of questionnaire is designed to ask the respondents' opinions on how knowledge sharing and management in general supports and contributes to organizational competitiveness in the business

environment. The respondents indicated that knowledge management supports quality management in maintaining competitive advantage in rapidly changing business environments by preserving the knowledge about its customers and market condition. Knowledge gain is used to anticipate changes in business environments. The result is summarized in table 1.6. Most of the respondents agreed that organization knowledge can be used to differentiate/improve products or services, to recognize customers and potential customers and non customers.

Table 1.6: Competitive Advantage

Statement	Don't Know (%)	Strongly Disagree (%)	Disagree (%)	Agree (%)	Strongly Agree (%)
Employees spend their time in value added activity by addressing client specific issues rather than reinventing what has already been done earlier.	11.10	0.00	44.40	33.30	11.10
Knowledge acquired has become a constant stream of new business from existing customers.	11.10	0.00	33.30	44.40	11.10
Organization knowledge creates a learning relationship aimed at establishing collaborative relationships on long term basis with customers.	0.00	0.00	22.20	55.60	22.20
Information acquired from customers enable the organization to anticipate changes in customer preferences and to consistently deliver excellent service.	11.10	0.00	0.00	33.30	55.60
Knowledge gained is used to differentiate and/or improve product/service according to customer needs as well as to recognize non potential customers.	11.10	0.00	0.00	55.60	33.30
Information collected is used to resolve issues before they become problems.	11.10	0.00	33.30	22.20	33.30

Any form of technology that is used by an organization is aimed at maintaining knowledge about markets, customers, and business environments.	0.00	0.00	11.10	55.60	33.30

Chapter 5

Conclusion

The purpose of this study was to determine the application of knowledge management techniques used for managing quality systems in selected manufacturing organizations in Coles and Effingham counties. The outcome of the study will be used to establish a framework for examining the relationship that exists between knowledge management principles and techniques and the implementation and management of quality systems in selected manufacturing organizations. The questionnaires were designed to answer the following research questions:

1. To what extent knowledge management and quality management techniques are used in the organization?
2. To what extent knowledge is shared and used to improve processes at the current site as well as other sites of organizations?
3. Does knowledge management support quality management to provide a competitive advantage to organizations?
4. Can quality teams re-use available knowledge to achieve commitment to change in responding to rapid changes in business environments?

It can be inferred from respondents that knowledge management and quality systems management overlap in organizations. Both management systems support each other in the business environment. Preserving and sharing knowledge is necessary for organizations. Diverse team-work and cross departmental training can be used as a tool in sharing knowledge. It is important that all employees have the access to an organizations' knowledge. Organizations' knowledge is used as learning tools to

recognize customers, potential customers as well as non-customers. It is used to improve the quality of products and assist organizations in maintaining their competitive advantage. Knowledge about customers, products, process, and market helps organizations to deal with change in business environments.

QM and KM are complementary and equally necessary in organizations. Quality impacts the product and business processes, which are essential to the survival of all organizations. On one hand, QM can use knowledge in improving its quality. On the other hand quality depends on the intellectual capital of organizations, which is the organization's knowledge network focusing on continuous improvement. The quality of an organization's knowledge repository depends on the investment in human resources.

Recommendations for Further Study

Quality Management and Knowledge Management cultivate a spirit of improvement, which in turn leads to better processes and better quality of products and services. This study explored the relationship between both management systems. The relationship exists in term that quality management focuses on performing knowledge processing in order to decide how to manage business processes in order to produce quality products or services. Knowledge management focuses on managing knowledge processing in order to accelerate innovation to solve problems in business processing. One very important issue is that of the possible integration between both management systems. Further study should focus on how this study can be extended to study the integration of KM and QM? Are Knowledge Management and Quality Management integrated in non-manufacturing settings (e.g., hospitals, govt. agencies, schools and universities)? For example, what is the effect of using technology for knowledge

management sharing in university environments? Can knowledge management improve the quality of education and services? Can knowledge management be used to provide competitive advantage to universities?

This study focused on selected manufacturing organizations. Large organizations have more resources and funds in leveraging their collective knowledge to increase responsiveness and innovation to justify their services. Halliburton for example undertakes the implementation of knowledge management and six sigma to improve business processes and increase efficiency. Further study can explore how the dynamic between KM and QM is different in larger organizations.

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August 24, 2005

Dear_____:

My name is Merlin Haryati, a graduate student from the School of Technology at Eastern Illinois University. I am currently working toward the completion of my thesis and would very much appreciate your response to the enclosed questionnaire. The purpose of this study is to determine the application of knowledge management used for managing quality systems in selected manufacturing organizations in Coles and Effingham Counties. The outcome of the study will be used to establish a framework for examining the relationship that exists between knowledge management and quality systems management.

Your responses will be kept confidential and will be used only for this study. If requested, upon completion of the study, I will gladly provide you with a summary of research findings. Please send a request for a summary of research findings via email at cgmh3@eiu.edu.

I would appreciate your responses to the questionnaire by September 12, 2005. I have provided a stamped, addressed envelope for your convenience.

I understand that your time is valuable; however, the brief time that it will take you to complete and return this questionnaire will greatly assist me in this research and in the completion of my degree.

Thank you in advance for your participation. If you have any questions about the study, you can contact me by email at cgmh3@eiu.edu or Dr. Larry Helsel by phone at 217-581-7427 or 217-581-3226 or by email at lhelsel@eiu.edu.

Yours Sincerely

Merlin Haryati

cc: Dr. Larry Helsel, Thesis Director

Knowledge Management Applications for Managing Quality Systems

The purpose of this survey questionnaire is to determine the application of knowledge management used for managing quality systems in selected organizations in Coles and Effingham Counties. The outcome of the study will be used to establish a framework for examining the relationship between knowledge management principles/techniques and the implementation/management of quality systems.

Part 1: Demographic Information

1. What is your title? _____
2. Years in current position? _____
3. Years of employment in this organization? _____
4. How many employees do you have in your department? _____
5. How many employees are there at your location? _____
6. Is the organization a member of American Society for Quality (ASQ)? Yes ___ No ___
7. Is the organization certified under ISO 9000? Yes ____ No ____
8. Do you use any Knowledge or Knowledge Management Software?

   Yes____ No ____ Don't Know ____

   If your answer is yes, please specify the name of the software

   _____
9. Does the organization have a quality information center? Yes ____ No ____
10. What technology components significantly contribute to knowledge sharing? (Check all that apply)

Internet & Intranet		Groupware	
Corporate Portal		Data Warehouses	
Relational Databases		Data Mining	
Text & Document Search Engines		Website Content Management	

Part II: Knowledge Management and Quality Management Application

Using the scale provided below, rate the level of importance of the items to managing knowledge in your department.

Not Important	*Minor Important*	*Important*	*Very Important*
1	*2*	*3*	*4*

1. ____ Organization's strategy and goals are included in employee's training program.
2. ____ Inclusion of knowledge performance in employee performance appraisal
3. ____ Clear and timely communication by management.
4. ____ Employee participation in the decision making process.
5. ____ Discussion groups & benchmarking.
6. ____ Formal and informal feedback between managers and employees.
7. ____ Standard processes for knowledge contribution and retrieval of information stated as clearly and simply as possible to employees across the organization.
8. ____ Employee teams for the application of diverse knowledge, skills, and experiences.
9. ____ Employee recognition for contributions to the department /organization.
10. ____ Virtually distributed existing knowledge to other departments, and locations of the company so that information relevant in near-term decisions can reach the right people ahead of time.
11. ____ Embedding knowledge in products, services, and processes assists in delivering higher-quality, individualized offerings that secure customers.
12. ____ Suppliers treated as strategic business partners on a long- term basis.

Part III: Knowledge Sharing

Using the scale provided below, rate to what extent you agree with the following statements.

Strongly Disagree	*Disagree*	*Agree*	*Strongly Agree*
1	*2*	*3*	*4*

1. ____ Employees are ***encouraged*** to share with others what they learned from their recent assignments.
2. ____ Employees are ***required*** to share with others what they learned from their recent assignments.
3. ____ Busy schedules often prevent senior staff members from sharing their work related experiences.
4. ____ The department has a well-organized system for sharing knowledge (e.g. regular training sessions, employee presentations on various projects) within deparments or skill areas (e.g., cross departmental presentations).
5. ____ The department has a well-organized system for sharing knowledge across skills areas.
6. ____ There is an expectation that employees or employee teams will regularly share reflections on learning experiences with other employees in the same deparments/organization.
7. ____ Experiences of employees are available in a retrievable format.
8. ____ Sharing knowledge systematically is part of the firm's culture.

Part IV: Knowledge Management Supports Competitive Advantage

Please use the scale provided below to respond to each item.

Strongly Disagree	*Disagree*	*Agree*	*Strongly Agree*
1	*2*	*3*	*4*

1. ____ Employees spend their time in value added activities by addressing client specific issues rather than reinventing what has already been done earlier.
2. ____ Knowledge acquired has contributed to a constant stream of new business from existing customers.
3. ____ Organizational knowledge creates a learning relationship aimed at establishing collaborative relationships on a long term basis with customers.
4. ____ Information acquired from customers enables the organization to anticipate changes in customer preferences and to consistently deliver excellent service.
5. ____ Knowledge gained is used to differentiate and/or improve products/services according to customer needs as well as to recognize non-potential customers.
6. ____ Information collected is used to resolve issues before they become problems.
7. ____ Any form of technology that is used by an organization is aimed at maintaining knowledge about markets, customers, and business environments.

Thank you for your participation in this research project. Please return your completed questionnaire in the envelope provided by September 12, 2005.